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| EXAMINER |
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DOLAN, JENNIFER M

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| ART UNIT | PAPER NUMBER |
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2813

DATE MAILED: 03/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/800,245

Applicant(s)

COLLINS, DOUG

Examiner

Jennifer M. Dolan

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 January 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) 14 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 and 15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 4/8/05.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group I, claims 1-13 and 15, in the reply filed on 1/20/06 is acknowledged. The traversal is on the grounds that the method and product groups are closely related, and thus it would be more expeditious to examine both groups in a single application. This is not found persuasive because the two groups are distinct under the provisions of MPEP §806.05(f), since the product as claimed could be made by alternate processes, such as selective growth of the mesa, rather than an etch, or by depositing the oxide regions, rather than performing an oxidation. Additionally, the product claim does not require the step of forming a current confining region using oxidation.

The requirement is still deemed proper and is therefore made FINAL.

2. Claim 14 is withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 4 and 8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 4 recites the limitation that etching the sidewalls removes material such that the sidewall is substantially vertical throughout the *first* parallel mirror stack. The specification (see spec, bottom of page 14 – top of page 15; figure 4) as well as claim 1 suggest that the second, or upper, mirror stack is the one being etched, and thus having a substantially vertical sidewall throughout the stack (see figure 1; the second mirror stack has a vertical sidewall throughout the stack, whereas only a couple periods of the first mirror stack are etched to have vertical sidewalls, and thus does not have vertical sidewalls throughout the stack).

For the purpose of examination, it is assumed that the sidewall is substantially vertical throughout the second mirror stack.

Claim 8 recites the limitation of “the high aluminum content AlGaAs layers.” There is insufficient antecedent basis for this limitation in the claims. For the purpose of examination, it is assumed that claim 8 depends upon claim 5, such that all terms have appropriate antecedent.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

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6. Claims 1, 4, 5, 7, 8, 11, 13, and 15 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent Publication No. 2004/0081215 to Johnson et al.

Regarding claims 1, 7, 13, and 15, Johnson discloses a method for manufacturing a VCSEL, comprising: providing a substrate (12, 160), forming a first parallel stack of mirrors (16, 172) on the substrate (figures 2, 8; paragraph 0027); forming an active (20, 176) and spacer (18, 22, 177, 178) layers on the first parallel mirror stack (figures 2, 8; paragraph 0028); forming a second parallel mirror stack (238, 180; paragraph 0029) on the active and spacer layers; etching the second parallel mirror stack to define a mesa structure (figures 8, 10a, 10b); oxidizing the mesa structure to form a current-confining central region in the mesa, where the oxide region extends into the sidewalls and forms strain induced regions (paragraphs 0037, 0049, 0051, 0057); and etching the outer sidewalls of the mesa to remove oxidized material (figure 10b; paragraph 0065), wherein the etch inherently reduces the electrical conductance of a portion of the second mirror stack (removal of material from fig. 10a to figure 10b narrows the area through which current can flow, and thus necessarily reduces the conductance).

Regarding claim 4, Johnson discloses that the step of etching the sidewalls leaves substantially vertical sidewalls throughout the second mirror stack (see figure 10b).

Regarding claim 5, Johnson discloses that the mirror stacks include alternating high and low Al content AlGaAs layers (paragraph 0031, 0051) and that oxidizing the mesa includes oxidizing at least the high Al content AlGaAs (paragraph 0043, 0051, 0057).

Regarding claims 8 and 11, Johnson discloses etching the oxidized sidewalls of the high Al content AlGaAs layers (see paragraphs 0049-0051; figure 10a, cross-hatched portion on

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sidewall is the oxidized material, which is subsequently removed in figure 10b) using a dry etching process (paragraph 0065).

7. Claims 1, 2, 5-10, 13, and 15 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,714,572 to Coldren et al (PG-publication date 6/6/02).

Regarding claims 1, 7, 13, and 15, Coldren discloses a method for manufacturing a VCSEL, comprising: providing a substrate (see fig. 1), forming a first parallel stack of mirrors (n-type DBR; see column 1, lines 26-45) on the substrate; forming an active (MQW region-figure 1) and spacer (AlAs) layers on the first parallel mirror stack (figure 1); forming a second parallel mirror stack (p-DBR; see column 1, lines 26-45) on the active and spacer layers; etching the second parallel mirror stack to define a mesa structure (column 1, lines 40-45, column 4, lines 45-50); oxidizing the mesa structure to form a current-confining central region in the mesa, where the oxide region extends into the sidewalls and forms strain induced (oxidized) regions (column 2, lines 20-24; column 4, lines 49-53); and etching the outer sidewalls of the mesa to remove oxidized material (column 3, lines 10-15; column 4, lines 53-67), wherein the etch inherently reduces the electrical conductance of a portion of the second mirror stack (removal of sidewall DBR material narrows the area through which current can flow, and thus necessarily reduces the conductance).

Regarding claim 2, Coldren discloses etching at least a portion of the first parallel mirror stack (column 1, lines 43-45; column 4, lines 46-49; etching is disclosed as being two periods into the bottom, or n-mirror).

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Regarding claims 5 and 8, Coldren discloses depositing alternate layers of high and low Al content AlGaAs, where at least the high Al content AlGaAs layers are oxidized (column 1, lines 32-35; column 2, lines 17-25), and where the etching includes etching the high Al content AlGaAs layers (figures 2a, 2b, 3a, 3b; column 4, lines 52-67).

Regarding claim 6, Coldren discloses oxidizing by flowing nitrogen gas with water moisture over the sidewalls at a temperature of approximately 400 degrees C (column 4, lines 49-52).

Regarding claims 9 and 10, Coldren discloses wet etching, where the wet etch may include dilute HF in DI (column 4, lines 52-67; column 3, lines 35-45; BOE etch is a dilute HF/DI etch).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Johnson et al.

Johnson discloses removing all of the oxide from the sidewalls of the mesa (see figure 10b; paragraph 0065), but fails to specifically quantify the amount of sidewall material removed from the mesa.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to specify in the method of Johnson that at least one micron of sidewall depth is

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removed from the mesa sidewalls. The rationale is as follows: A person having ordinary skill in the art would have been motivated to remove sufficient sidewall oxide material to reduce or eliminate the electrical artifacts and defects resulting from the presence of oxide material in the DBR stack (see paragraph 0065), and thus improve the stability and reliability of the device (see paragraph 0043). Although Johnson does not specifically teach that such a quantity is “at least one micron”, it has been held that “where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (1955).

10. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Johnson et al. in view of U.S. Patent No. 5,115,441 to Kopf et al.

Johnson fails to disclose the method of formation of the top electrical contact.

Kopf discloses that the top contact of a VCSEL is formed by depositing a layer of dielectric material (20) on the mesa shaped structure (figure 1); etching an opening (window 21) through the dielectric layer in the mesa shaped structure (column 4, lines 50-55; column 6, lines 1-10; column 7, lines 29-35); and depositing material on the mesa shaped structure including optically transparent, electrically conductive material (23; column 2, lines 20-30) defining an electrical contact window to control current distribution within the laser (column 4, lines 50-60). It is presumed that Kopf deposits the disclosed layers to produce ‘desired’ characteristics.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the VCSEL production method of Johnson to use the top electrical contact formation method taught by Kopf. The rationale is as follows: A person having ordinary skill in

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the art would have been motivated to use the optically transparent conductive material deposited in a dielectric window, because doing so restricts the current flow only to the lasing portion of the VCSEL (see Kopf, column 4, lines 50-60), thus improving the efficiency of the device.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent No. 6,014,400 to Kobayashi discloses a VCSEL formation method including depositing a SiO protective film on the DBR before performing the oxidation for the oxide aperture, and then etching to remove the SiO film, such that the completed device includes the oxide aperture but no oxidation of the DBR layers.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer M. Dolan
Examiner
Art Unit 2813

jmd


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